# Illinois River Watershed Project

Summary Report – January 29, 2018

## Background

The State of Oklahoma has designated six rivers as "Scenic," including the Illinois River and two of its tributaries. Oklahoma's water quality standards apply a phosphorous criterion of 0.037 mg/L to the Scenic Rivers, but levels are often found to be in the range of 0.01 - 0.15 mg/L at the Illinois River near the Arkansas-Oklahoma border. Oklahoma's Lake Tenkiller and portions of the Illinois River Watershed in northwest Arkansas and northeast Oklahoma are included on both states' Clean Water Act Section 303(d) lists of impaired waters. Phosphorus levels in the Illinois River are impacted by municipal discharges and nonpoint sources (i.e., runoff from poultry litter application sites). Downstream impacts to Lake Tenkiller are reflected by high chlorophyll-*a* and low dissolved oxygen concentrations in the lake, which result from nutrients including phosphorus and other environmental parameters.

Since late 2009, EPA Region 6 has been engaged in efforts to develop a robust scientifically defensible water quality models of the Illinois River Watershed (IRW) in northeast Oklahoma and northwest Arkansas in addition to Lake Tenkiller. The modeling efforts are designed to reproduce water quality conditions within the IRW and the lake. States, tribes, and local stakeholders have been engaged throughout the project. Principals made up of state and tribal water directors have been convened and calls have been held relaying progress and soliciting input on the direction of the project. The most recent Principals' call was held January 11, 2016.

In the Fall of 2015, EPA completed an initial calibration of the watershed and lake models as well as a sensitivity and uncertainty evaluation for those models. Since that time, EPA has been working closely with Arkansas and Oklahoma Agencies as well as with the Cherokee Nation to further refine the models and to build consensus around the effort as well as the technical underpinnings of the models. EPA has convened a total of six Technical Workgroup (TWG) meetings between April 2016 and November 2016 with the expressed purpose of refining the models and to garner the support of the state and tribal agencies. Members of the TWG consist of representatives from Arkansas and Oklahoma agencies and the Cherokee Nation. A list of TWG members and their contact information is attached to this summary. These TWG meetings provided opportunities to identify, discuss, and resolve technical issues and to increase buy-in by the states and tribe. Members of the TWG have expressed their support for providing a 90-day informal public review of the revised models where the agency would collect and evaluate comments from external stakeholders (e.g., Municipalities, Agriculture industry) the water quality models. Near the end of such informal comment period, EPA along with members of the TWG envisioned an informational public meeting to describe the models, discuss potential next steps, and receive comments from all stakeholders.

EPA's did not move forward to public notice the models early in 2017 due to the TWG's interest in making further refinements to the Lake Tenkiller model. EPA has since addressed those concerns and completed a revised and better calibrated model of the lake. TWG feedback on the revised lake model has been positive.

During 2015 and 2016, an Arkansas-Oklahoma Joint Committee commissioned a study to re-evaluate the Oklahoma Scenic River Total Phosphorus Water Quality Standard (WQS.) In December 2016, the study recommended a rolling six-month average phosphorus concentration not to exceed 0.035 mg/L. For the recommendation to take effect, it would need to be formally adopted and approved as an Oklahoma WQS. The recommendation is similar in magnitude to the current rolling 30-day average "shall not exceed" 0.037 mg/L WQS.

Since the beginning of the project, the EPA has expended about $1.5M and committed approximately 0.5 FTE to overseeing the project.

## Regulatory Framework and Technical Issues

The Clean Water Act (CWA) and its implementing regulations require that an upstream state's WQSs be protective of downstream states' WQSs. NPDES regulations prohibit pollutant discharges which may cause or contribute to an in-stream excursion above water quality criteria and also require that permit effluent limits be consistent with the assumptions and requirements of any approved waste load allocation (WLA).

### Technical Issues and Resolutions

As part of the consensus building efforts engaged in by the Agency, the TWG highlighted areas where the models needed to be refined in order to provide a more robust demonstration that the models were working correctly. Most of the following issues were raised by Arkansas Natural Resource Council consultant, Dr. Brian Haggard of the University of Arkansas. The areas identified and the resolution agreed upon follow. Additionally, calibration was mainly evaluated at the Arkansas/Oklahoma State line and at Tahlequah, OK. Each step was evaluated based on temporal and spatial improvement as well as root mean square error calculations.

### Meteorological Data Review

NEXRAD Meteorological data used as input to the HSPF (the watershed) model was reviewed and compared to National Climatic Data Center (NCDC) data for Fayetteville, AR. NEXRAD data matched the NCDC data and was determined to be useable in the model by the Technical Workgroup. Therefore, no changes were made.

### Litter and Fertilizer Applications

A question arose as to how the watershed model was representing the timing of litter and fertilizer applications in the watershed. The Oklahoma Department of Agriculture, Food and Forestry provided data and the TWG recommended modifications which were made regarding litter application in the watershed model.

### Flow Balancing

Given the low flow (drought) conditions which spanned the 2005-2006 period included in the watershed model, the TWG completed a thorough review of the watershed model's water balance function. Based on guidance from the TWG, EPA revised the model inputs to reflect additional flow in headwater type streams which resulted in a more robust calibration of modeled to actual flow data.

### Surface and Upper Layer Fractioning

Some concern was raised regarding the watershed model's representation of nutrient distribution at various depths in the soil. The TWG evaluated data showing surface and upper soil layer contributions of nutrients from both poultry litter and seasonal fertilizer applications. After extensive review and analysis including multiple model reruns, a 10% surface and 90% upper layer allocation for litter and fertilizer was selected as yielding the most representative response.

### Atmospheric Deposition of Nitrogen

The TWG noted a calculation error in the input file regarding both wet and dry deposition of nitrogen in the model. EPA revised the model to correct the calculation error.

### Denitrification

Denitrification rates (KNXy) were initially set based on literature rates. Those initial KNXy rates were set to the lowest possible values in the watershed model. Dissolved oxygen (DO) thresholds as well as the ammonia, nitrite, nitrate, and DO based denitrification rates were all adjusted with input and evaluation by the TWG.

### Baseline Model Run Conditions

In an effort to take into account the various changes in the watershed over the temporal model domain, the Technical Workgroup developed a baseline model run which can be used to assess impacts and reductions moving forward. The baseline run utilizes the following data:

2009 Litter Application Rates

2011 National Land Cover Data

2015 DMR flows and Permit Limits

2015 Point Sources

Meteorological data from 1992 – 2009

### Conceptual Approaches and Scenarios

Conceptual approaches have been discussed at TWG meetings. An adaptive approach to managing nutrients in the watershed and possible nutrient reduction scenarios have been discussed within the TWG.

### Lake Tenkiller Model

Lake Tenkiller has received less attention from the TWG than the watershed model due to a number of factors. However, in the Fall of 2017, the TWG evaluated output from a newly revised version of the Lake Tenkiller Environment Fluid Dynamic Code (EFDC) model and supported its further use.

## Current Conditions

At present, the TWG has agreed that the watershed model is useful for making decisions regarding water quality. The TWG also reviewed output from the Lake Tenkiller model and found its output to adequately represent dissolved oxygen and Chlorophyll-*a* in Lake Tenkiller. EPA is finalizing the models, a general reduction scenario and drafting documentation that can be used to develop Total Maximum

Daily Loads (TMDLs), Watershed-based Plans (WBPs) or other efforts to improve water quality in the Illinois River.

## Future Steps and Anticipated Actions

EPA Region 6 anticipates providing finalized models, a general reduction scenario and documentation which can be used to develop Total Maximum Daily Loads or Watershed-based Plans to Arkansas and Oklahoma Agencies and the Cherokee nation in early April, 2018. EPA anticipates that the Arkansas Department of Environmental Quality and the Oklahoma Department of Environmental Quality will review the final water quality models, associated documentation, and general load reduction scenario in order to consider the establishment of TMDLs or WBPs within their jurisdictions.

## Stakeholders

Historically, Arkansas has expressed concern that Oklahoma's current phosphorus criterion for Scenic Rivers is overly stringent, while Oklahoma has maintained that the criterion is appropriately protective of designated uses and the Scenic status applicable these waters. Point source dischargers in the watershed are concerned that establishment of a TMDL will require expensive controls to meet waste load allocations for nutrients. Non-point sources in the watershed are concerned that establishment of a TMDL may provide pressure to accomplish non-regulatory load reductions.

## Correspondence and Inquiry

The modeling project has received significant interest from members of Congress as well as the Northwest Arkansas Regional Planning Commission, Tyson's Chicken and other concerned parties. For example, senator Boozman's office inquired on the status of the modeling effort in early 2016. The inquiry concluded with EPA HQ and Regional representatives meeting with the senator to discuss the details of the modeling as well as Region 6 and HQs staff supplying the senator's office with technical responses to his inquiries.

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